THE TELEGRAPHIC JOURNAL AND ELECTRICAL REVIEW.

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SIXPENNY TELEGRAMS.

THERE can be little doubt now but that the introduction of a sixpenny rate for inland telegrams in the United Kingdom is a matter of certainty, and that the time when the new tariff will come into force will not be long delayed. The Postmaster-General's reply to the deputation on the subject sent by the Society of Arts must, on the whole, be considered as very satisfactory. Mr. Fawcett stated that, so far as the Post Office is concerned, there would be no objection to accept a reduction in the price of telegrams if the reduction could be justified; but he also stated, what must be sufficiently obvious, that if the price charged is not sufficient to make the telegraph service commercially remunerative, the difference would have to be made up out of general taxation; and thus the general taxpayer would be fined in order to enable the senders of telegrams to send them at a lower rate than the market price. In principle, no doubt, this is perfectly correct, and were the use of the telegraph confined to a particular and small class of persons, it would have more weight than would otherwise be the case. The telegraph is, however, for the benefit of every one, and is well recognised as being such, though, of course, from its being inevitably more expensive than the penny post, it cannot be of such universal use as the latter. The general principle of taxing the many for the benefit of the few is so often and inevitably acted upon that it can hardly be considered as being an insurmountable obstacle in the question in point, more especially as the loss which may possibly ensue to the revenue cannot be heavy, and most probably will be no loss at all. It is, of course, necessary to draw the line somewhere. There are a number of undertakings of great public interest which might be undertaken by the Government at a reduced cost, with the probability of an eventual increase rather than decrease in the revenue resulting therefrom. The difficulty is to tell where to stop. It cannot be supposed that the introduction of the sixpenny rate is withheld from other motives than prudence. But even if a slight loss is likely to ensue to the revenue, the extra tax that will be necessary in consequence to make up the deficiency would be so very small, that, considering the advantages gained, it would not be grumbled at, and we feel sure that no one would consider that they are being taxed for the benefit of the few. We are inclined to think that Mr. Fawcett looks upon the telegraph as more of a luxury than circumstances justify, and does not class it, like the penny post, as one of the indispensables of the present century.

That the introduction of the sixpenny rate will cause a great increase in the message work is unquestionable, but to what extent it will go cannot be calculated; estimates on the question must in any case be of a very doubtful character,—there is really no sound basis upon which anything approaching a correct estimate can be made. In our own opinion, however, there can be no fears of the result of the proposed reform.

Although the Postmaster-General naturally hesitates to give a decided answer on the question before him, it is evident that he considers the matter as settled, and the point to be worked out is, how is the reduction in the tariff to be best effected? Mr. Fawcett suggests that a halfpenny word rate be adopted, with a minimum charge of sixpence, the address not being charged for; thus twelve words would be sent for sixpence. The proposal that a commencement should be made by applying the sixpenny rate to messages sent within the London district was, we think, wisely discountenanced by Mr. Fawcett. Want of uniformity is always a mistake, and the fact that a particular company before the transfer undertook the work at the sixpenny rate is really no argument in its favour. Rather than adopt such a change, Mr. Fawcett stated that he would rather wait a year or two and do the matter thoroughly. We quite agree in this; but now that the ball has been set rolling the matter will not stop, and we do not hesitate to say that early next year the desired alteration will be brought about.

CRIGHTON'S PATENT TERMINAL INSULATOR.

THIS invention has for its object the production of a terminal or shackle insulator so constructed as to render the insulation given by it more perfect than is attainable by the existing forms of terminal or shackle insulators used on open wire lines.

The improved terminal insulator is shown in longitudinal section by fig. 1, in plan by fig. 2, and in end view by fig. 3.

To the horizontal arm, A, carried by the telegraph post, B, is attached an insulating hollow conical body, C, by means of a metal encircling strap, D, and bolts, E, around which body is placed another insulating body or shed, F, which partially encloses the former (C) and is attached to it by cement.

Fig. 1.

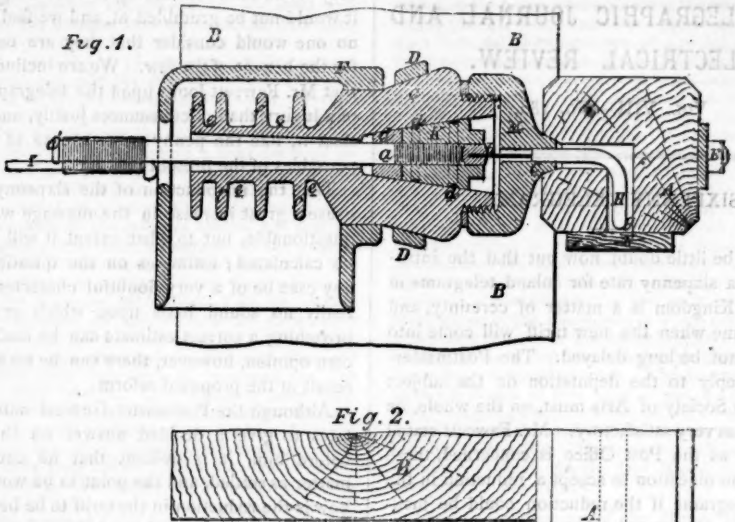


Fig. 2.

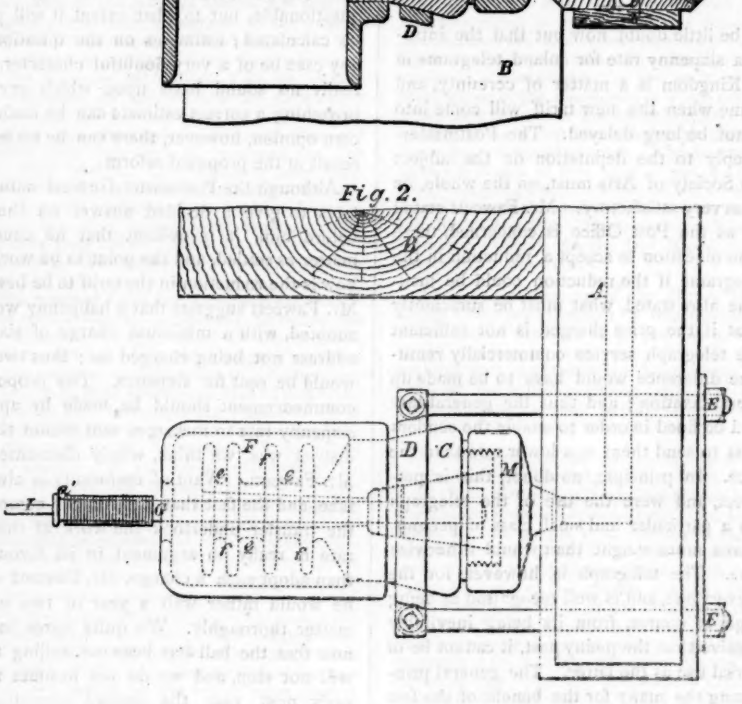
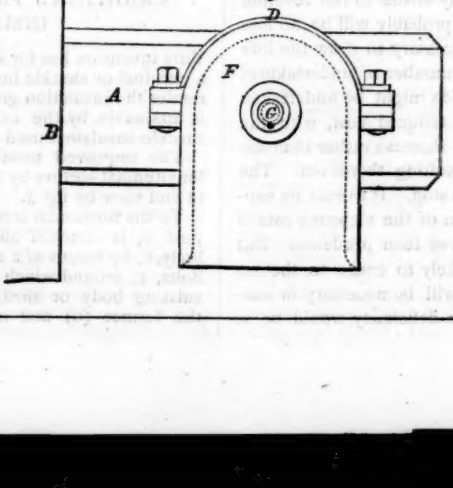


Fig. 3.



Through the centre of these parts so combined passes a conducting rod or bolt, G, for forming the connection between the "leading in" wire, H, and the aerial wire, I, and receiving the strain of the latter. This rod or bolt is screw threaded at its end, *a*, for the reception of a conical protuberence or plug, K, adapted to a similarly shaped aperture in the central body, C, and at this end is the point of junction, *b*, with the wire, H, the extremity of the central body, C, being closed with a screw cap, M, enclosing the end, *a*, of the bolt, G, and the joints at *b*, and leaving an orifice at *c* of a sufficient size only for the passage of the wire, H. The plug, K, which may be composed of any suitable material, is provided with washers or rings, *d*, *d*, of india-rubber or other similar elastic material, so as to form cushions or yielding bodies under the strain exerted by the aerial wire, I. To the end a^1 of the bolt opposite to the end *a* at which the wire, H, is attached, is connected the aerial wire, I, the connection being made in the usual manner. The central body, C, is provided upon a portion of its length with alternate annular or surrounding recesses, *e*, and projections, *f*, the object being to retard the passage of rain or moisture from the conducting rod or bolt, G, to the strap, D, which attaches the insulator proper to the horizontal arm, A. Thus the entry or passage of rain or moisture is first intercepted by the external insulating body or shed, F, but should it gain access to the interior by the rod or bolt, G, the moisture has to traverse the annular undulations, *e*, *f*, of the central insulating body, C, and escape from the other end of the external insulating body or shed, F, before it can arrive at the attaching strap, D, so that the continuity of damp or moisture and liability of the electricity escaping to earth through the rod or bolt, G, and the strap, D, is obviated or greatly diminished.

The horizontal arm, A, is grooved or recessed throughout its length on the underside, as shown at *g*, for the passage of the "leading in" wire, H, and is covered on the underside by a lid, N, so as to completely protect and enclose the wire.

In the case of shackle insulators the apparatus is constructed in substantially a similar manner, with the exception that as no connection with a leading in wire is required, the bolt and its connections are modified, as can easily be understood.

A NEW FORM OF OBACH'S GALVANOMETER.

THE galvanometer of Dr. Obach, which was fully described in the number of the JOURNAL for August 1st, 1879, is similar in form to the ordinary tangent instrument, but the inducing ring, instead of being fixed, is hinged so that it can be turned through an angle, and the effect upon the needle be thereby lessened in a certain definite ratio; by inclining the ring at different angles so as to obtain a similar deflection of the needle with two different currents the relative strengths of the latter can be ascertained, since they will be directly proportional to the *cosines* of the angles through which the ring was turned, from its vertical position, in the two cases. Mr. J. Rapieff has recently devised an important improvement upon this instrument by constructing it with *two* rings, one of which is fixed and the other movable. In measuring the strengths of two currents by this instrument the weaker current is made to traverse the fixed ring and the stronger current the hinged one; the latter is then turned through an angle until the needle of the instrument stands at zero, when the relative strengths of the currents can be determined by noting the angle through which the ring has been rotated. It is obvious that this differential principle is applicable to various kinds of measurements besides those of the strengths of currents.

The general form of the new instrument can be understood from the figure. It consists of two rings, R, R_1, the former of which may be fixed, and the latter movable around horizontal axes.

The left-hand ends of the ring, R, are insulated from each other, and from the axle and frame, and are connected to the terminals, *a*, a_1; the other ends of the ring, although they are in the sectional figure apparently separated and disconnected, are in reality not so, but are joined together on either side of the axle, so that the ring is practically continuous at this point, though insulated from the axis and the rest of the instrument at that place. Similarly the ring, R_1, is connected to the terminals, *b*, b_1, and is continuous but insulated from the axis, &c., at the left-hand side of the instrument.

The rings and axes are mounted on a stand with levelling screws, and to this stand is also fixed the dial and pivot of the magnetic needle, *n s*.

A graduated circle (not shown in the fig.) is attached to the stand, by means of which the angle through which the movable ring may be turned can be observed.

Two kinds of needles can be used with the instrument, viz., a short one with a long pointer fixed to it; this would be used when the instrument is worked as an ordinary Obach galvanometer. The other may be made of any reasonable length, and may be employed with advantage when the instrument is used differentially.

Comparative measurement of two current strengths.

Supposing the instrument to be set so that when no current is passing through either ring, the needle stands at zero. In fig. 2 let α and β represent the angles of inclination made with the horizontal plane by the fixed and movable rings, R, R_1, respectively, and let C and C_1 be the currents traversing the two rings in opposite directions; then when the needle is at zero

$$C : C_1 : : \sin.\ \beta : \sin.\ \alpha,$$

or

$$C \sin.\ \alpha = C_1 \sin.\ \beta;$$

that is

$$C_1 = C \frac{\sin.\ \alpha}{\sin.\ \beta}.$$

But since in the actual instrument the distance between the needle and the two rings is not the same, constants representing these distances must be introduced into the foregoing formulæ in order that they may be true.

Let the constant for the ring R be *p*.
" " " R_1 " *q*.

And also, if the rings be made of a number of turns of wire instead of a single band, then

Let the number of turns on R be *n*.
" " " R_1 " *m*.

And therefore the preceding formula becomes

$$C_1 = C \frac{np \sin. a}{mq \sin. \beta}.$$

If the inclination of the ring R be 90°, *i. e.*, if it be perpendicular to the horizontal plane in which the magnetic needle lies, then

$$a = 90 \text{ or } \sin. a = 1;$$

therefore we get

$$C_1 = C \frac{np}{mq \sin. \beta}.$$

The values of n, m, p, and q are easily determined in the first instance experimentally, in which case the formula may be written

$$C_1 = C \frac{K}{\sin. \beta}$$

where

$$K = \frac{np}{mq}$$

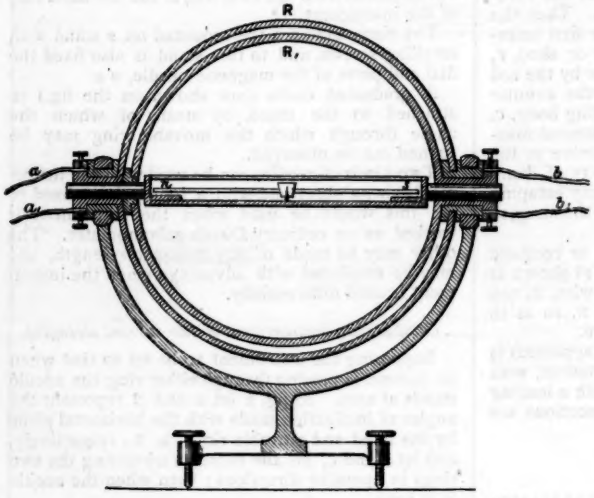


FIG. 1.

Determination of the value of unknown resistances.

The instrument being set so that the needle normally stands at zero, then in order to determine the values of resistances by the new galvanometer the latter would be used in the following manner:—

One pole of the battery would be connected to terminals, a and b, the other pole would be connected to one end of a known resistance and also to one end of the unknown resistance, and these two resistances would have their other ends connected respectively to terminals, a_1 and b_1, of the galvanometer.

The current being thus made to pass through the two rings in opposite directions, the movable ring must be turned until the needle is brought back to zero.

Let X be the unknown resistance in the circuit of the ring, R, whose resistance we will call R.

Let Y be the resistance in the current of the ring, R_1, whose resistance we will call R_1.

Taking the angles and constants the same as before, then we have

$$C : C_1 :: mq \sin. \beta : np \sin. a,$$

but also

$$C : C_1 :: Y + R_1 : X + R,$$

therefore

$$Y + R_1 : X + R :: mq \sin. \beta : np \sin. a,$$

therefore

$$(X + R)\, mq \sin. \beta = (Y + R_1)\, np \sin. a,$$

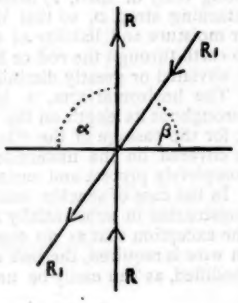


FIG. 2.

that is

$$X = (Y + R_1) \frac{np \sin. a}{mq \sin. \beta} - R$$

if $a = 90°$, or $\sin. a = 1$, and we put $\frac{np}{mq} = K$,

then

$$X = \frac{(Y + R_1) K}{\sin. \beta.} - R$$

MR. FAWCETT ON POSTAL TELEGRAMS.

A DEPUTATION from the Council of the Society of Arts waited upon Mr. Fawcett, the Postmaster-General, on July 17th, at the General Post Office, for the purpose of bringing before him the subject of the cost of inland telegrams, with a view to its reduction by the substitution of a minimum charge of 6d. for inland messages in place of the present charge of 1s. Amongst the gentlemen forming the deputation were Lord A. Churchill, Mr. Andrew Cassell, Mr. E. Chadwick, Mr. G. C. Barclay, Admiral Sir F. Nicholson Banks, and Rear-Admiral Mayne, C.B.

Lord R. CHURCHILL and Mr. CHADWICK having urged that the hour had arrived when it was thought that a great advantage might be conferred upon the country by a reduction being made in the cost of inland telegrams,

Mr. FAWCETT, in reply, said: No member of this deputation can recognise more fully or strongly than I do the great advantage which would be conferred upon the entire community by a reduction in the price of telegrams, or by the adoption of any other means which would facilitate internal communication. Probably no service which can be rendered by a Government to a country is so great as that of facilitating the means of communication. In order that there may be no misunderstanding, I wish to state at the outset of my remarks, with as much distinctness as possible, that so far as this department is concerned, there would be no objection to accept a reduction in the price of telegrams if the reduction could be justified. In saying this, I think I am expressing the views of my colleagues and other officials of the department. In estimating what ought to be the price to be charged, I think we ought to keep steadily in view these two principles. If the price charged is not sufficient to make the telegraph service commercially remunerative, the difference would have to be made up out of general taxation, and thus the general taxpayer would be fined in order to enable the senders of telegrams to send them at a lower rate than the market price. It seems to me that this would be just as indefensible as to impose a tax upon the community in order that a grant in aid of a certain class of wages might be given, or to give a bounty to some particular trade in order that the commodities of that trade might be sold below cost price. On the other hand, I wish with equal distinctness to state that if a price is charged for a telegram more than sufficient to make the service remunerative, then the difference between the price which would make it remunerative and the price charged is really so much taxation imposed upon telegrams just in the same way as if the tax-gatherer stood over the sender of the telegram and levied a tax at the moment the telegram was sent. If it could be proved that 8d. would be a remunerative price, then if 1s. is charged, 8d. is paid for the service rendered and the other 4d. may be regarded as a tax imposed upon telegrams. It is obvious that it is not for this department, nor for me holding the office I hold, to express an opinion as to the way in which the taxation of the country should be raised, or whether it is advisable or not that the taxation of the country should be raised upon the means of internal communication. That is a question not for this department, but for the Chancellor of the Exchequer and the Government generally. The principles I have laid down at starting, I think it important to keep steadily in view, because it seems to me that upon them must chiefly be determined the price that ought to be charged for telegrams. Of course, every one would like to have the price of telegrams reduced, but the question must be determined by financial considerations, and those considerations I will endeavour to lay before you as distinctly as I can and with as much brevity as possible. The telegraph revenues show an improvement in the best sense of the word, because I find not only the gross receipts increasing, but the net receipts increasing in a more rapid ratio. I will give you the gross and net figures for the year 1876 and for the last financial year, which closed on the 31st March last, and you will see that they abundantly prove the satisfactory result I have mentioned. The gross receipts from the telegraphs in 1876 were £1,287,000, while the outlay for working expenses, renewals, &c., were £1,090,000, which shows a profit realised of £197,000. I refer to the year 1876, because it was the year in which a very important Select Committee of the House of Commons, presided over by Dr. Lyon Playfair, inquired into the telegraph system of the country. Passing on to the year which closed on the 31st March last, we find that the gross receipts have increased to no less a sum than £1,471,000, but that the working and other expenses have not increased in anything like the same ratio, owing to great economy being introduced into the service and in consequence of improvements in the means of telegraphing. This largely increased revenue was obtained at a comparatively slight addition of cost. I find that the working expenses only increased from £1,090,000 in 1876 to £1,117,000 last year, so that the profit for the last financial year was £354,000. The profit during the past four years has increased from £197,000 to £354,000. The result becomes the more satisfactory when we turn to the capital account. I find that this increase in profits of nearly £160,000 was obtained with a comparatively small addition to the capital account of about a million. During the present year the progress seems to be going on in an increasing ratio, for comparing the receipts from telegrams for the first three months of the present year with the corresponding three months of the previous year, I find an increase in receipts amounting to £80,000, and my friend Mr. Patey, the superintendent at the head of the department, considers, after making careful estimates, that the profit on telegraphs during the present year will amount to £450,000. Of course, a considerable portion of this increase is due to the extended work of the telegraphs and to the general advancement of the system throughout the country. But I am bound in candour to admit that no small part of this satisfactory result is due to the admirable manner in which the telegraph service has been managed by the permanent officials, and their readiness to adopt suggested economies and take advantage of scientific improvements. Having laid these financial results before you, I will proceed to consider what would be the best method of reducing the price of telegrams, and then I will lay before you what would be the probable result of the suggested reduction. Now of all the many suggestions made for reducing the price there seems to be a particular one which has so many advantages over the others that I shall almost entirely confine my attention to it. As you are probably aware, all foreign telegrams are sent at what is known as the word rate. If, for instance, you send a telegram to France or Belgium the charge is at per word, and the result is that short telegrams can be sent to the Continent at less cost than those sent from one part of England to another. It seems to me that if any change be made in the present rate it should be in the direction which this country has so persistently pressed upon other countries. The plan suggested and which I would recommend is a modification of the word rate. I would propose, for instance, a halfpenny word rate, and that the minimum charge should be sixpence. Consequently a telegram of twelve words, including the address, could be sent for sixpence, and a halfpenny a

word would be charged for every additional word. Now it seems that there are several advantages to be derived from the adoption of this particular method of charge. In the first place it would prevent the waste which prevails under the present system. It is notorious that in the great majority of telegrams sent a great many unnecessary words are used, and if the word rate were adopted this would not continue. Then another advantage would be that a person would be charged according to the amount of work which the State did for him. At present there is this anomaly —that a person may send a single word and a short address, and be charged as much as the person who sent twenty words and a long address. It has been suggested that there should be two rates charged—sixpence and a shilling—and that the shilling messages should always take precedence. I would never sanction such a scheme as that, as I regard it of the greatest importance to make no distinction in messages, and that the first in the office should be first sent out. I have now to direct your attention to the important question as to what would be the financial effect of adopting the sixpenny rate. Soon after I was appointed to the office I now hold, my attention was directed to the subject, and I asked Mr. Patey to prepare a careful estimate of what would be the probable effect of reducing the price of telegrams to sixpence for twelve words, with a charge of a halfpenny a word for every word beyond that. Without troubling you with details, I will give you briefly the result of Mr. Patey's estimates. He estimates that if the sixpenny rate had been adopted this year there would have been a falling off in the income, and that the working expenses would have been augmented by some £50,000. The diminution in the receipts would amount on the year to £112,000, and he also estimates that during the present year the additional capital expenditure necessary for new wires and office accommodation would be £100,000. Treating this as capital to be paid off in a certain period by a sinking fund, I will set down for it an annual charge of £5,000. Therefore you have £50,000 increased working expenses, £112,000 for loss of revenue, and £5,000 for interest on extra capital. This gives a total of £167,000 as representing the estimated cost of the reduction in the price for one year. I think it quite possible that, although the reduction would lead to an immediate loss of revenue, like other improvements, it would ultimately prove remunerative. It may be asked, "Why do you not introduce the 6d. tariff on a limited scale, say for London and some other large towns?" As a metropolitan member, you may suppose that I would not like unnecessarily to oppose any proposal to give special benefits to the metropolis. It is said that London has a special claim because 6d. telegrams existed before, but I do not think that the public derived much advantage from that, as the cost for porterage was very heavy. Moreover, the facilities which the Government have offered to London since it took over the telegraphs are remarkable. At the time the telegraph purchase was made there were only 60 offices in London, whereas at the present time there were 400, and the number was steadily increasing. So great in fact has been the increase in the amount of business done that the number of messages sent from one part of London to another had risen from 250,000 when the telegraphs were taken over to a million and a half at the present time. I will now consider what would be the financial result of the reduction in price for London and some other large towns only. I find that it would only diminish the loss by about £50,000 or £60,000, and still leaving by the reduction a loss in revenue on the year of £120,000. I think it would be extremely unfortunate, for the sake of £50,000 a year to deprive the entire country of the benefits of an uniform rate. As at present advised, I would rather wait for a year or two, and have the thing done completely. I think I have said enough to show you that the question of the reduction of the price of telegrams is a financial one which cannot be determined by myself or this department, but must be considered by the Chancellor of the Exchequer and the Government generally. In conclusion, allow me to make this remark, which it seems important you should bear in mind, that I cannot help thinking that the true position of the Post Office in this country is this: It has two distinct duties to discharge—the first being to supply revenue, and the second to supply certain services for the country. The amount of the revenue the Chancellor of the Exchequer has to determine, whilst we have to provide the maximum advantage for the community. If it should be decided that the country is in a position to sacrifice £167,000 of revenue, I certainly would offer no objection to the reduction.

The Deputation then thanked the right hon. gentleman, and withdrew.

TELEGRAPHIC APPARATUS IN USE IN THE BRITISH POSTAL TELEGRAPH DEPARTMENT.

XIV.

BATTERIES—(*continued*).

THE "Chamber" battery, which was described in the last article, although very convenient, is not all that can be desired. From the fact of its being made in so many parts it is liable to sustain damage, especially during transit, and, moreover, it cannot be packed for the latter purpose except in considerable bulk, from the necessity of packing material being placed between each porcelain chamber. Now, except as regards the porous partition, the "Ordinary" sulphate battery is very substantial in make, and is not liable to damage from rough usage; a form of battery, therefore, which would combine the strength of the "Ordinary" and the conveniences of the "Chamber," would obviously be a good pattern. These facts have been thoroughly appreciated, and at the present time a battery constructed on these lines has commenced to be employed in the Postal Service, and will form the standard sulphate battery in all cases where the Daniell description is necessary.

The new battery will be called the "Daniell" simply; its cells are of rather greater dimensions than those which have been hitherto in use, and from the consequent large size of the zinc and copper plates, their internal resistance is small.

Like the "Ordinary," the new pattern battery consists of a teak trough divided into cells by slate partitions, the whole of the inside being coated with marine glue, so as to render the cells perfectly water-tight; a small partition about half an inch high is set at the bottom of each cell so as to keep the porous pots in their place. The shape of these pots is similar to those shown by fig. 61 in the last article, and the zinc and copper plates are like those indicated by fig. 60 in the same article. The general arrangement of the cells will be understood from fig. 62.

The trough of the battery is 18 inches long, 9 inches wide, and 9 inches deep, including the lid; it is divided into five cells. The porous pots are

4¼ inches high, 5¼ inches broad, and 1¾ inches from back to front. The zinc plates are 4⅜ inches wide and 2½ inches deep without the lug, which latter is 1 inch long and 1¼ inches wide, the latter dimension corresponding to the width of the copper strap connecting the plates. The copper plate is 4 inches wide and 4½ inches deep.

The action, charging, maintenance, &c., of the new pattern battery are precisely similar to those described for the other forms.

THE U. K. BATTERY.

This battery, which is still extensively used in the Postal Service, is so called from its having been the form employed almost universally by the "United Kingdom" Telegraph Company previous to the transfer of the latter into the hands of the State.

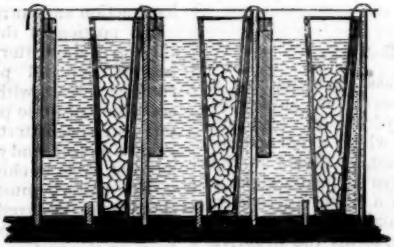


FIG. 62.

FIG. 63.

Fig. 63 represents this form of battery. Each cell consists of a round glazed brown earthenware jar, 5 in. high and 4⅜ in. wide, holding one quart. A zinc cylinder, slightly smaller in diameter than the inside measurement of the cell, is contained in the latter. This cylinder is of cast-zinc, and weighs about 2¼ lbs.; it is not continuous all round, but is cast with a gap; if this were not the case it would be impossible to remove any particular cell without dismantling a large number, perhaps all, the cells in a set. A porous pot of white unglazed porcelain is placed concentrically within the zinc cylinder, and contains a copper plate bent into a cylindrical form; the top and bottom of the porous pot are saturated to a distance of half an inch from their ends with paraffin wax or ozokerit. Crystals of sulphate of copper are placed inside the porous pot, and the cell is charged and cleaned in the same way as the cells of other forms of Daniell's battery.

From fig. 63 it will be seen that the porous pot is set upon a little tripod; this is formed of gutta-percha, and having a recess in it in which the porous pot fits, it serves to keep the latter concentric with the zinc cylinder.

From the large size of the electrodes, the U. K. battery has a very low resistance, which is a great advantage for certain purposes.

Although a very large number of U. K.'s are at present in use, it is intended that they shall be superseded by the new "Daniell" battery.

Faults prevalent in Daniell Batteries.

The marine glue coating the joints in the slate partitions sometimes chips off; this causes the zinc and copper pair hanging over the division to be on short circuit and to exhaust the sulphate crystals and solution in which the copper plate is immersed. The fact of this exhaustion will at once enable the faulty partition to be detected. A fault of this kind practically throws two cells out of use, and can be remedied temporarily by connecting the copper straps of the next and the preceding cell together

by a piece of wire; the chambers on either side of the faulty partition should also be emptied, as, although not absolutely necessary, it stops the waste going on in those cells. In the "Ordinary" battery the porous partition sometimes becomes cracked, allowing the sulphate of copper solution to enter the zinc chamber; in this case the copper straps of the plates on either side of the faulty porous partition should be bridged across with a piece of wire, so as to cut the cell out. The porous partition also sometimes becomes so hard as to offer a very high resistance; the temporary remedy is the same as in the last case. Where the fault is caused by a faulty porous *pot*, of course the remedy is obvious.

It occasionally happens that one cell will have all its sulphate crystals exhausted before those in its neighbours'; this may be due to a deficiency of the salt in the first instance, but is more likely to be owing to a faulty partition.

THE LECLANCHÉ BATTERY.

This battery consists of a glass jar, containing a solution of the ordinary commercial sal ammoniac (which is a combination of hydrochloric acid and ammonia). A zinc rod, into which a connecting tinned iron wire has been cast, is placed in the solution and forms the positive element, whilst a plate of carbon, surrounded by a mixture of broken gas-carbon (or coke) and peroxide of manganese, and contained in a porous pot, forms the negative element. To make an attachment for the terminal, the top of the carbon plate is capped with lead, which makes good metallic contact with the carbon, and is not liable to be attacked by ammonia, as brass would be. The upper part of the carbon plate is dipped in melted paraffin wax to fill up its pores; if this were not done, the liquid would ascend by capillary action and attack the lead cap, forming a layer of white lead, which would cause a disconnection; this was a common fault in the earlier batteries.

Lastly, the wire, the top of the zinc rod, and the lead cap of the carbon plate are covered with pitch, ozokerit, marine glue, or some other compound, to protect them from local action.

The action of the Leclanché battery is to dissolve the zinc and form zinc chloride, and some other salts of zinc which are not soluble in water, but are soluble in a solution of sal ammoniac and water; to reduce the peroxide of manganese to a lower oxide; and to form ammonia, which is given off as a gas. Thus, after a time, new zinc will be required, the sal ammoniac must be replaced, and the porous cell which contains the peroxide of manganese must be renewed. When the solution of sal ammoniac becomes too weak to dissolve the zinc salts, they form themselves in crystals on the zinc rod and porous pot, and if the solution becomes too highly charged with these salts (super-saturated), the crystals form in the substance of the porous pot and crack it. This is prevented by a periodical renewal of the sal ammoniac solution.

As was first pointed out, there is no local action or waste of material when the battery is not in action, so that, if the evaporation of the liquid is prevented, it may be allowed to remain untouched for months or even years without losing power. The time the battery will last is entirely dependent on the amount of work it has to do.

It polarises so quickly that it should not be employed for local battery purposes or for double current circuits, or circuits where permanent currents are used.

To charge the Battery.

The glass jar must be filled about half an inch high with crushed sal ammoniac, about 2 oz. in weight, and the porous pot and zinc rod set in their places. The glass jar must next be *half filled* with water. A little water must also be poured into the porous cell through the holes in the top, to moisten the manganese mixture and to establish a conducting medium between the different sections of the battery.

Care must be taken that neither water nor sal ammoniac remains on the terminals, otherwise local action and corrosion will set in.

No portion of the protecting compound about the top of the battery should be knocked off; if it is, the exposed portion must be varnished or covered afresh with the compound. A cement composed of three parts by weight of ozokerit and one part of Chatterton's compound is that which is generally used, and which is found to be very tough and not liable to chip off.

The battery must be kept dry and clean. It should not be fixed in a warm place, otherwise evaporation takes place too rapidly and crystals form on the surface of the glass, which, by capillary action, will often drain off nearly the whole of the liquid. It should be examined periodically, according to the amount of work it has to do. The solution should be bright and clear. If it has become cloudy, it is an indication that sufficient sal ammoniac is not present to dissolve the zinc salts. *All* the solution should then be drawn off and the cell again charged, as at first, with a fresh supply of sal ammoniac and water. The porous pot and zinc rod should then be thoroughly scraped and cleaned. The crystals which have formed on the porous pot are best removed with a damp cloth. If the pot shows signs of cracking, it must be replaced by a sound one. The zinc rod, when reduced to half its original size, should be replaced.

The connecting wire should be carefully examined, and any portion of the metal which may have become bare should, after being thoroughly cleaned, be well covered with the cement above described. If this is not done, the ammonia fumes will speedily eat through the wire and cause a disconnection. If there be none of the cement at hand, a piece of tallow well laid on will prevent corrosion for some time, but no time should be lost in procuring a supply of the cement.

Faults prevalent in the Leclanché Battery.

The cracking of the porous pot, due to the formation of crystals in its pores. The corrosion of the connecting iron wires, due to the action of ammonia. The disconnection of the connecting wire of the carbon plate, due either to the lead cap making imperfect contact with the carbon or to the formation of salts of lead between the lead and the carbon. The cracking of the glass jar, due to imperfect annealing, also takes place sometimes, but this fault

is much less frequent than it used to be, as more care is taken in the manufacture.

THE BICHROMATE BATTERY.

This battery is made in two sizes; the smaller size consists of a glass or stoneware jar of the same size and pattern as that employed for the "U. K." battery. Inside this jar is placed a porous pot containing a short stout zinc rod with a broad base; a little mercury is also placed in the bottom of the pot, which keeps the zinc well amalgamated. In the outside jar is placed a carbon plate about two inches wide and a ¼-inch thick. A small lead cap is fixed to the top of the carbon, a piece of platinum foil being placed between the two; the upper part of the carbon has its pores filled with paraffin wax. The connections made in this way are very satisfactory and are never known to fail.

To charge the Battery.

In the outer jar (small size) are placed 4 oz. of a prepared bichromate salt, which consists of bichromate of potash in combination with sulphuric acid, also 4 oz. of sulphuric acid are added; the jar is then filled up with water. In the porous pot 2 oz. of mercury are placed, and it is then filled up with water. If the battery is required for immediate use about half a teaspoonful of sulphuric acid is added in the porous pot, but this is not necessary if the current is not required for a day or two after the charging.

When the battery is charged a portion of the sulphuric acid passes into the zinc cell, and, when the battery works, this acid attacks the zinc and forms sulphate of zinc, while the hydrogen generated at the carbon plate reduces the bichromate of potash to a lower form. The mercury keeps the zinc perfectly amalgamated, so that but little local action takes place; there is secondary action in the battery when the solutions become saturated, which results in the formation of beautiful dark violet crystals of "chrome-alum" on the carbon plate. This is a double salt, a sulphate of chromium and potassium.

The secondary action just referred to is only to be prevented by the occasional withdrawal of some of the liquid and its replacement by fresh sulphuric acid and water, an operation which should be performed immediately the deposition of crystals is detected. The crystals themselves should of course be removed.

As long as the colour of the bichromate solution remains *orange* little need be done, but if it turns *blue* fresh bichromate salt should be added; if the colour remains orange, and yet the battery fails, some fresh sulphuric acid must be added. At the same time half of the solution in the porous pot should be replaced with water.

If the battery does little work it will last three or four months without being touched, but if it be worked hard it must be examined about once a month.

If the solution becomes blue, notwithstanding the presence of a sufficiency of bichromate salt, and the zinc becomes dirty and coated with deposit, the battery must be entirely cleaned. In doing this great care should be taken not to waste the mercury either in the pot or on the zinc. The best plan is to insert the pot and its zinc undisturbed in an open jar, and place them under a water tap. The whole of the solution in the pot, together with the deposit, will then be washed away, but the mercury will remain behind. The carbon and the outer jar simply need washing in water; the battery can then be charged as before. Crystals that remain in the cells unchanged in colour can be used again, but all others must be rejected. The zinc can be used as long as any portion remains.

SECONDARY BATTERIES WITH CARBON ELECTRODES.

By SAUVAGE HENRI, Commis Principal des Télégraphes at Evreux.

IN his researches on electricity, M. Planté has studied the secondary currents produced by voltameters with plates of copper, silver, tin, aluminium, iron, zinc, gold, platinum, and lead, these last two metals giving the most intense secondary currents, and the most utilisable in consequence of the long duration of the latter and the conservation of the charge on the plates when the circuit is open.

The study of a voltameter with carbon electrodes deserves to be made also.* To commence with, in this voltameter, if the gas obtained by electrolysis of the water is collected, it will be found that the gas from the positive pole only measures about ⅓th of that disengaged from the negative pole; there has, therefore, been an absorption of carbonic acid, the formation of which, under these circumstances, has been proved amongst others by M. Becquerel in his *Traité Experimental de l'Électricité*, page 243, Vol. III., published in 1835. At the negative pole there is undoubtedly a production of hydrogen and carbureted hydrogen, as in the elements with carbon and zinc electrodes which I experimented upon and published a description of in *Annales Télégraphiques* for July, 1875.

By prolonging the action of a battery composed of seven small sized Callaud cells, and a voltameter formed by two rectangular carbon pencils immersed in distilled water, acidulated by a small drop of sulphuric acid, I obtained a result which appears never to have been noticed before. At the end of seven or eight hours, the carbon which received the oxygen in a continuous manner commenced to disengage it, and the water assumed a black tint, which continued to become darker, until the complete disintegration of the portion of the positive carbon immersed in the liquid took place; the other carbon remained intact.

This water, when passed through a Berzéhein filter, remained black after having left on the paper finely divided carbon; treated with acetate of lead it lost its colour. It appears amongst other things that this colour is not due to finely divided carbon held in a state of suspension. A leaf of paper with which the voltameter was left covered showed, after the experiment, black, smoky deposits; on the other hand, if the voltameter was carefully examined by a strong light, bubbles of gas could be

* A voltameter with carbon electrodes was employed some time ago by Mr. Varley to give time signal currents.

seen detaching themselves from the carbon, and carrying with them particles which fell gently back when the bubbles cleared, rising and falling again according to the jerks and alterations of the bubbles as they moved about, finally deposit themselves at the bottom of the glass vessel, to remain in suspension, or to burst out unmistakably with the gas outside the water, according to their degree of tenuity.

This state of extreme division has been observed before with gold under the effect of electric discharges, a red powder being deposited. "It appears," says M. Becquerel, page 305, Vol. III., of his treatise, "that this state is due to the extreme fineness of the division of the particles, since it cannot be admitted that gold oxidises at the temperature at which its oxide ordinarily reduces itself.

Two Callaud elements do not produce this disintegration; they fall to zero, and all disengagement ceases. Three elements produce it feebly and gently after 20 hours' action on closed circuit. With four elements the disintegration is more lively. And finally, with seven elements, the action takes place after seven or eight hours with the circuit closed.

It appears that this disintegration of the carbon at the positive pole is an action analogous to that which M. Planté noticed in his lead plates; after a long "formation" the plate acquired "a peculiar crystalline aspect, and the molecular construction of the metal became altered to a certain depth, the peroxidised plate becoming even rather brittle."

The voltameter with simple electric light carbons gave a secondary current, which produced full deflection on the needle of a zinc galvanometer, and then allowed it to fall back to 7° after being on closed circuit through no other resistance for two minutes; after rest it again produced the full deflection, which latter fell back quickly to 7°, and then slowly to zero.

The study of the secondary current given by large surfaces is interesting. An element formed by means of grains of gas carbon placed in a porous pot of a capacity of about 200 cubic centimetres, and placed in the midst of an equal volume of grains of carbon in a Callaud jar, was charged by a battery of seven Callaud elements; the secondary current observed on the zinc galvanometer, without any other resistance, fell from full deflection to 7° after three minutes of closed circuit; it remained still at 135° * five days after the charging, and after six other observations, or after five days of repose and eight minutes of discharge taken seven times.

The couple was compared during this time with an element with lead plates, exposing three square decimetres of surface, "formed" as near as possible on the method of M. Planté. After having been charged by the same battery and during the same time, the Planté element fell 25° in three minutes; it did not give more on the fifth day, after five discharges of a total duration of five minutes, than a jump of 70°, falling back immediately to 5°.

The element with carbon electrodes remained still at 90° on the 20th day, and at 80° on the 25th day after 26 observations.

* In default of another means, all the deflections higher than 90° have been taken by leaving the dial of the sine galvanometer fixed at that point.

This experiment, confirmed by others numerous and repeated, establishes the fact that the element with carbon electrodes gives a secondary current of an intensity equal to, and of a duration superior to, those which are obtained from lead electrodes.

Nevertheless, the advantage is to the latter as regards quantity, at least, with the elements tried; the elements with lead plates would raise to a state of redness for 10 seconds a thin platinum wire, when the elements with carbon electrodes would scarcely warm it; the two joined up for quantity would keep it red for 45 seconds.

This should be the case: from the surfaces of the lead plates being very close together, from the great affinity of peroxide of lead for the hydrogen, and from the absence of any solid diaphragm, the reaction should be more sudden and prolonged between the two plates of lead of the Planté system than between the masses of carbon in which the gas is occluded.

If an element is constructed with an electrode of carbon exposing a divided mass, and an electrode of lead exposing a surface, one obtains, by having hydrogen on the carbon and oxygen on the lead, a secondary current of less quantity than that obtained from the Planté system, and of less duration than that of the system with two carbon electrodes. In three minutes the current falls from full deflection to 105°, but it gave 90° still at the end of 12 days after charge and after 11 observations; it gave 80° on the 17th day, and at the end of 24 days and 23 observations the deflection was still 58°.

A similar element charged in the reverse way fell to 15° on the fourth day after four observations of a total duration of four minutes.

(*To be continued.*)

Notes.

THE BRITISH ASSOCIATION.—The fiftieth meeting of this Association will be held at Swansea this month. The President Elect is Professor A. L. Ramsey, LL.D., F.R.S., Director-General of the Geological Survey of the United Kingdom. The inaugural address will be delivered on the evening of the 25th August, when the existing President, Professor J. Allman, will resign. The first *soirée* will be held on Thursday, August 26th, and there will be a second on Tuesday, August 31st. The session will be closed on September 1st by a general meeting at 2·30 p.m. The Swansea reception rooms will be opened for the convenience of members and visitors on Monday, August 23rd, at 1 p.m. On the following days they will be opened at 8 a.m. The following is a list of the officers for the various sections, subject, of course, to any possible modifications:—Section A. Mathematical and Physical Science. Professor W. G. Grylls Adams, President; Messrs. J. A. L. Glaisher, Oliver J. Lodge, D. MacAlister, and W. E. Ayrton, Secretaries. Section B. Chemical Science. Mr. J. H. Gilbert, President; Messrs. H. B. Dixon, Eaton Hodgkinson, Phillips Bedson, and J. M. Thomson, Secretaries. Section C. Geology. Mr. H. C. Sorby, President; Messrs. W. Topley and W. Whitaker, Secretaries. Section D. Biology. Mr. A. C. Gunther, President; Messrs. Bloxam M'Nab, Priestly, and Howard Saunders, Secretaries. Section E. Geography.

Lieut.-General Sir John H. Lefroy, President; Messrs. H. W. Bates, C.G.D., Black, and E. C. Rye, Secretaries. Section F. Economic Science and Statistics. Mr. G. W. Hastings, President; Messrs. N. A. Humphrey and C. Molloy, Secretaries. Section G. Mechanical Science. Mr. James Abernethy, President; Messrs. A. T. Atchison and H. Trueman Wood, Secretaries.

Arrangements have been made for visiting several important metallurgical works in the vicinity of Swansea, which will impart a special interest to the excursions that form so attractive a feature to the annual meetings of this Association.

THE *Gazette of India* announces the appointment of Mr. Mance as engineer and electrician to the Persian Gulf Telegraph. Mr. G. Sealy, late assistant superintendent Persian Gulf Telegraph, is promoted to superintendent; Mr. R. C. Laughlin, assistant superintendent 1st grade Indian Telegraph Department, is appointed to officiate as superintendent 3rd grade from May 18.

AUSTRALIAN TELEGRAPHY.—The Postmaster-General of South Australia has received a letter from the Deputy Postmaster-General of Victoria, acknowledging the receipt of a letter, notifying the approaching completion of the proposed new telegraph line between Adelaide and Melbourne, and stating in reply to Mr. Todd's inquiry respecting the progress made in Victoria with the line to connect therewith, that directions have been given for a survey of a line from Dimboola to be proceeded with immediately, with a view to establish the necessary connection at as early a date as practicable.—*Engineering.*

AN article from the pen of Mr. J. Laister, of the Telegraph Department, General Post Office, entitled "The Whitewashing of Shylock," appears in the July number of *Modern Thought.—The Civilian.*

POSTAL TELEGRAMS.—The petition transmitted by the Council of the Society of Arts to the Postmaster-General, asking him to reduce the tariff of inland telegrams, runs as follows:—

To the Right Honourable Henry Fawcett, M.P., Her Majesty's Postmaster-General.

The Memorial of the Council of the Society for the Encouragement of Arts, Manufactures, and Commerce

Respectfully sheweth,—

That the Council are strongly of opinion that the time has now arrived when the charge on inland telegrams might be reduced, and a minimum charge of sixpence substituted for the present one of a shilling.

They submit that the charges on inland telegrams in this country are higher than in other European countries, the rates in France, Germany, Belgium, and Switzerland all being lower than in England. It is even a curious anomaly that a telegram can be sent from any part of the United Kingdom to Belgium or to France for less than the smallest sum for which a telegram may be sent from one part of London to another.

The Council do not propose to make any suggestions as to the details of the method by which the reduction of charge should be effected; whether by employing a lower tariff within certain limited districts, such as the metropolis and its suburbs, or the country within a certain radius of a provincial town; or, secondly, by adopting a word-tariff, with a minimum charge of 6d. The precise details are, the Council feel, safely to be left to the department itself.

They feel sure, however, that a reduction in the tariff would be accepted as a boon by a large number of those who are prevented by the present rates from using the telegraph as largely as they would wish, and that the business of the department would soon be so increased as to fully compensate for the lessened revenue which might be the first consequence of the proposed change.

(Signed)

ALFRED S. CHURCHILL, Chairman of the Council.
H. T. WOOD, Secretary.

POSTAL TELEGRAPHS.—In the House of Commons on Tuesday, the 27th instant, Dr. Cameron rose to call attention to the report of the Select Committee of 1876 on Postal Telegraphs; and to move that, in the opinion of this House, the time has arrived for adopting the policy of "increased telegraphic facilities and diminished charges" advocated by the Select Committee on Postal Telegraphs as "the true method of making the Telegraph Department remunerative." The hon. member was speaking in support of the resolution at ten minutes to seven, when, in accordance with the rules, the debate was suspended.

THE danger and inconvenience caused by the network of telephone wires over large towns was the subject of discussion at the Liverpool Town Council a short time ago. Alderman A. B. Forwood agreed that the wires were likely to prove a nuisance, and said that when in New York lately he counted in one place 500 wires over his head. The Town Clerk intimated that the Association of Corporations had taken up the question, and intended to draw the attention of the Home Office to the subject.

THE officers of the old British telegraph companies held their annual meeting on Friday last at the Salisbury Hotel, Fleet Street, when about twenty sat down to dinner under the presidency of Mr. Graves, the engineer-in-chief of the Postal Telegraphs, Mr. E. B. Bright, late secretary of the Magnetic Company, being vice-president. The absence of Messrs. H. Weaver and W. Andrews, through illness, was much regretted by all. Mr. W. T. Ansell, Mr. T. C. Bennett, Sir Charles Bright, Mr. Muirhead, Mr. G. Newman, Mr. W. H. Preece, Messrs. Ratcliffe, Mr. Sach, Mr. Sanger, Mr. Spagnioletti, and Mr. Lewis Wells were present.

THE £5 prize and silver medal for the Honours Examination in Technical Telegraphy, instituted by the City and Guilds Institute, has been awarded to Mr. H. M. Sayers, of the Central Telegraph Department, General Post Office. The second prize was gained by Mr. E. C. Pink, also of the same department.

IN the House of Commons on Tuesday, 20th ult., Mr. Walpole, in reply to Mr. D. Grant, said that owing to the risks incidental to the use of gas in the British Museum, the trustees had not seen their way to sanctioning the lighting up of the British Museum, so that it could remain open to the public till 10 p.m. The experience gained by the use of the electric light in the reading-room would not justify the extension of that system of lighting to other parts of the building, as there were no means at present of securing a sufficient number of separate lights to burn steadily and without interruption. The trustees would take the earliest opportunity that presented itself of giving effect to the wishes of the hon. member, when a means was discovered of doing so with safety.

TENDERS for lighting by the electric light several of the main thoroughfares of the City of London are to be asked for shortly. The area within which the lighting

will be tried is bounded by Cheapside and the Thames, from Blackfriars Bridge to London Bridge. The three bridges, London, Southwark, and Blackfriars, will be included in the scheme, and the main lines of light will stretch from Blackfriars, along both Queen Victoria Street and Ludgate Circus to Cheapside, through King William Street to London Bridge, with a cross line from Cheapside to Southwark Bridge.

IT is proposed to light the Guildhall and London Institution libraries and reading-rooms by the electric light.

AT a fête held at Paris on the 14th ult. the electric light was largely used. It was employed to illuminate the Gardens of the Tuileries, the upper part of Notre Dame, the Bourse, the dome of the Panthéon, Port St. Denis, and other buildings. The fête, being national, was celebrated all over France in the 40,000 communes or townships of the Republic, and the electric light was used in the provinces as well as in Paris. At Rouen a group of sixteen Siemens lights, of a power of about 100,000 candles, was placed on the top of the spire of the Cathedral.

A TOWER 200ft. high, with a powerful electric light at the top, is to be erected in the town of Holyoke, Mass., to illuminate the locality.

MR. TROUVÉ has recently devised an improved form of Siemens armature for electro-motor or dynamo-electric machines. Instead of making the pole faces straight and parallel with the axis of rotation he gives them the shape of a snail, so that they pass before the magnet poles gradually. The result is stated to be very satisfactory.

THE *Journal of Gas Lighting* says:—"Considerable importance was recently given by some English and French papers to the fact that the Paris *Salon* was to be lighted by electricity, and the asserted superiority of this light over gas for the illumination of paintings was accepted unquestioned by those who were too indifferent or too prejudiced to inquire very closely into the matter. We find, however, that a class of persons who must be admitted to have some slight knowledge of what is a good and what a bad light for a picture—the artists themselves—have protested against the use of the electric light at the *Salon*, this being stated to be the most unfavourable kind of illumination for effectively showing off their productions. The protest, however, comes rather too late. The agreement entered into with the Jablochkoff Company for the supply of the electric light has been carried out, and this system will, we suppose, remain in use until the end of the season, artistic protests notwithstanding. Again, when sober-minded, right-thinking people ventured to express a doubt as to the permanent adoption of the electric light by those shopkeepers in Paris who had been so ready to take it up as a novel and attractive, not to say startling kind of advertisement, their remarks were received by the worshippers of the rising luminary with all the impertinent contempt usually manifested towards opponents by converts to a new faith. Yet what do we find? The *Figaro*, whose office in the Rue Druot was one of the first buildings to be illuminated exteriorly by means of the electric light, has positively abandoned that system, and substituted for it two gas lamps similar to those used by the Paris Gas Company in the Rue du Quatre Septembre, where, by the way, only half the original number of burners are now lighted, and yet the general illumination of the thoroughfare is, we learn, if anything, a trifle better than that of the neighbouring Avenue de l'Opéra, where the electric light still reigns supreme."

A CORRESPONDENT of the *Standard* says:—"That the Municipality of Havre have just entered into a contract with the Société Générale d'Electricité (Jablochkoff's patent) for lighting up by electricity the harbour and docks of Havre. This contract follows that between the Chemin de fer de l'Etat Belge, also with the Société Générale d'Electricité for lighting the Antwerp basins. In both cases the contract is for 10 years."

THE *Atti dei R. Accademia dei Lincei*, fasc. 6, May, contains a paper by Dr. Maggi on the distribution of electricity in equilibrium on two parallel indefinite plane conductors, subjected to the induction of a point in the space included by them. Also a paper by Professor Macaluso, on the electric polarisation produced by metallic deposits.

M. GOSTYNAKI has devised a new form of galvanometer, the principal advantage of which consists in the fact that direct proportionality is realised up to near 90°. The instrument has a continuous coil, *i.e.*, without slit for passage of an astatic system. A U-piece of aluminium wire, suspended by a cocoon fibre, supports two astatic systems of the same direction, crossed at an angle of 45°, and connected together. The double astatic system has a mirror attached to it, so that the movements are reflected on a demi-cylindrical scale having the suspension fibre for its axis, and projected on a small vertical sight placed behind the mirror. The proportionality has been proved in some 150 crossed observations.

HOW QUICKSILVER IS PRODUCED.—The *Western Morning News* publishes the following account of a thunder-storm which occurred in the middle of last month:—"Reports from the rural districts to the north of Cork, and in the direction of Mallow, represent the storm as of a terrific character. At the telegraph office, at the railway stations, all the instruments were destroyed. A ball of fire struck some of the instruments and fell on the floor, breaking as it did so into small globules. One of these, on being examined, was found to consist of quicksilver."

ELECTRO-BRASS PLATING.—According to the *Chemical Society's Journal*, M. J. J. Heoz uses the following bath, which differs materially from former formulæ:—84 grammes sodium bicarbonate, 54 grammes ammonium chloride, and 13 grammes potassium cyanide are dissolved in 2 litres of water. To render the bath active the sides of the vessel are covered with a sheet of brass, which serves as anode, whilst another piece of brass hangs in the bath and forms the cathode. The current is allowed to pass through the bath for one hour, when it is ready for use. It is better to employ cast brass. In order to tin directly on zinc the author uses the following mixture: 50 grammes sodium phosphate, 50 grammes salammoniac, 25 grammes sodium bicarbonate, and 25 grammes tin salt dissolved in 1 litre of water. Instead of sodium phosphate Rochelle salt may be employed.

WRITING to *Nature*, Mr. F. T. Mott gives an interesting description of a curious electric phenomenon, observed on the 22nd June. He says:—"At about 4·30 p.m. this day a severe thunderstorm with a deluge of rain came up from the north-west and lasted about an hour. At 5·30 my wife was standing at the window watching the receding storm, which still raged

in the south, just over Leicester, when she observed, immediately after a double flash of lightning, what seemed like a falling star, or a fireball from a rocket, drop out of the black cloud about 25° above the horizon, and descend perpendicularly till lost behind a belt of trees. The same phenomenon was repeated at least a dozen times in about fifteen minutes, the lightning flashes following each other very rapidly and the thunder consisting of short and sharp reports. After nearly every flash a fireball descended. These balls appeared to be about one-fifth or one-sixth the diameter of the full moon, blunt and rounded at the bottom, drawn out into a tail above, and leaving a train of light behind them. Their colour was mostly whitish, but one was distinctly pink, and the course of one was sharply zig-zagged. They fell at a rate certainly not greater than that of an ordinary shooting star. I have never witnessed a phenomenon of this kind myself, but my wife is a good observer, and I can vouch for the trustworthiness of her report."

MR. JAMES JOHNSTONE sends to the *Edinburgh Daily Review* the following interesting account of the effects of a thunder-storm observed on the 7th ult. He says:—"On the 7th curt., about 4·15 p.m., the lightning struck the craig which is named on the plan of Edinburgh 'The Dasses,' which overhangs the Hunter's Bog on the east. The results are so extraordinary that they are worthy of notice in your columns. The rock struck is of the hardest basalt, commonly called whinstone. The lightning did not strike the sharp, serrated, front edge of the craig, as might have been expected, but, on the contrary, it struck the flat top covered with sod at a distance of 3 ft. from the present edge, and that must have been between 6 and 8 ft. from the edge before the accident; for the lightning detached several tons of the rock from the front of the craig, and sent six large masses of rock down into the Hunter's Bog. The largest of these measures 4 ft. long by 3 ft. broad and 1 ft. thick, but of irregular shape. On the edge of the craig the lightning detached a mass of rock, which now stands in a very precarious position. This large mass measures 4 ft. 9 in. long by 3 ft. broad and 1 ft. 4 in. thick. The top of the craig, a short distance from the front of it, is covered with a coating of angular pieces of basalt, and on the top of these a covering of sod. It was on the sod the lightning struck, and made a hole 2 ft. 6 in. long by 1 ft. 6 in. broad. The largest diameter of the hole is in a direction from N.W. to S.E. and the lightning continued its course in this direction, ploughing a furrow in the sod for a distance of 19 yards, the furrow diminishing in width as it receded from the original hole, where it measures 5 in. wide. These facts establish the direction in which the lightning came, and correspond with the observations of three gentlemen who were in a house on the west side of the Hunter's Bog, and saw the lightning pass across the Bog to the rock on the east side, namely from N.W. to S.E. In the *Times* of 14th October last, notice was given that a committee of scientific gentlemen had been appointed by insurance and other companies to investigate the effects of lightning with a view to providing the best means for protecting buildings, and a request was made that all persons who could furnish information on this subject would do so. In consequence of this notice I wrote a letter to the *Times* on 25th October, containing the following information, which it is important persons should know who wish to watch thunderstorms, and give the information asked. There are three kinds of thunder-storms. First, those that take place between clouds, the lightning flashing from cloud to cloud; second, storms in which the lightning comes from the clouds down to the earth; third, storms in which the lightning passes from the earth to the clouds. It is the two latter kinds of thunder-storms which affect the question of the protection of buildings. The damage done to them and to trees by lightning varies in a remarkable manner, according to whether the lightning went from the earth to the cloud or from the cloud to the earth.

"The lightning which struck the Dasses Craig has an important bearing with reference to the protection of buildings from lightning. The common theory is that lightning will always be attracted to and strike the highest or most prominent point in its vicinity. The Dasses Craig is near the bottom of the valley, bounded by Salisbury Craigs on the W. and S., and Arthur's Seat on the E. High land and prominent rocks surrounded this craig on all sides, and yet the lightning passed all these and decended into the valley to strike it.

"Another interesting fact. On placing a compass near the hole made by the lightning I found that the needle deviated from the N. to the E., and when the compass was in the hole, the needle stood at E.S.E., instead of N., proving that the rock was still powerfully electrical at the spot where the lightning struck it. But, except in the vicinity of the hole, the craig did not affect the needle."

SOME researches by Herr Röntgen in the same line as those by Dr. Kerr, revealing a new relation between light and electricity, are described in the *Annalen der Physik*, No. 5; the methods were somewhat varied. Special attention was given to the direction of vibration of the light in the liquid, and the author's results seem in the main to confirm Dr. Kerr's views. Dr. Kerr got an effect with nitro-benzol only when a spark-interval was introduced in the connection of the one electrode with the conductor of the machine, giving a sudden discharge through the liquid. This Herr Röntgen considers due to the comparatively good conductivity of nitro-benzol; the spark discharge effects a brief but large difference of potential (not obtained in the other case), producing sudden luminosity in the field of vision. But Herr Röntgen obtained the same effect with all the badly-conducting substances he examined; it was only of longer duration. A welcome method is thus afforded for examining comparatively good conducting liquids as to electro-optic properties, and Herr Röntgen thus demonstrated, for glycerine, sulphuric ether, and distilled water, an influence of electricity on the transmitted light. The author offers (doubtfully) a different hypothesis of the phenomena to that of a direct action of electricity on the light vibration.—*Nature.*

ACCORDING to some experiments made by Professor Quincke, dielectrics undergo either expansion or contraction, according to the nature of the substances; thus, in most cases, the result of surface electrification is to produce a minute expansion, but fatty oils and resins contract under similar circumstances. Herr Quincke applies his measurements to explain the phenomena observed by Kerr of the double refraction of light exhibited by dielectric media when under electrostatic strain; and he shows that the optical effects in the two classes of media are opposite in character.

ONE YEAR'S PROGRESS.—The American Union has issued a handsome map of its lines and connections, dated May 15th, 1880. On the back it is stated that the company was "organised under the general laws of the State of New York, on May 15th, 1879.

"Within one year from the date of its organisation, notwithstanding the most determined opposition, which

has in every instance failed, the American Union has erected over 25,000 miles of new wire, leased the lines of the Dominion Telegraph Company of Canada, made an exclusive contract with the new French Atlantic Cable Company, and established connections with the lines of many important railroad companies, as shown on the within map, giving it in all a system of lines, in the United States and Canada, of 50,000 miles of wire, and 1,550 offices, and also cable communication with Europe. The American Union is the strongest opposition telegraph company ever established in America. As its lines have reached the various larger cities they have been opened for business at the prevailing rates, and even under these circumstances the result has been most liberal and emphatic. The management of the company therefore feels assured of its success; and, with the promise of reduction of rates as the extension of the system will from time to time warrant, relies upon such patronage as will be profitable to the company, and emancipate the public from the exactions of a monopoly."—*Operator.*

SOUTH AUSTRALIA, Victoria, and New South Wales have agreed to a uniform charge of 3s. per 100 words on all press telegrams sent between the three colonies by day or night.

THE Commission for the construction of the Trans-Saharan Railway has determined that this great work shall be preceded by the establishment of a telegraph line connecting Algiers with St. Louis in Sengal *via* Timbuctoo.

A NEW ATLANTIC CABLE.—The Telegraph Construction and Maintenance Company's steamships *Seine*, *Kangaroo*, and *Scotia*, have sailed from the works at Greenwich with the sections of the new cable for the Anglo-American Company.

THE first number of a new scientific periodical, entitled *Les Découvertes*, was published in Paris on the 22nd ult. The numbers will appear weekly, and will give full illustrated descriptions of the inventions and discoveries of the day.

BY means of an improved telephone the Adelaide Post Office chimes have been clearly heard at Port Augusta, a distance of 240 miles.

City Notes.

Old Broad Street, July 28th, 1880.

EASTERN TELEGRAPH COMPANY, LIMITED.—The sixteenth ordinary half-yearly meeting of the proprietors of this company was held July 15th, at the City Terminus Hotel, Mr. J. Pender, M.P., in the chair. The chairman, in moving the adoption of the report (*see* TELEGRAPHIC JOURNAL, p. 251, previous issue), said that the net revenue for the six months ended the 31st March, 1880, amounted to £291,194, against, in the half-year of 1879, £235,077. Of this increase £4,000 was attributable to telegrams sent by the Cape line opened for traffic on the 29th September last. Their receipts from this source were now at the rate of from £19,000 to £20,000 per annum, their own estimate having been, when they proposed the Cape cable, that they would get £15,000. They were already getting £20,000, and he did not think he was expressing a too sanguine opinion when he said that when they next met they might look forward to an income from this source of £25,000 (hear, hear). They had also been able to show a substantial increase throughout their whole system. There was a sum of £4,850, being a quarter's dividend of their holdings in the South African Company after having written off £1,000 in reduction of cost. The South African Company was paying six per cent., and there was evidence that it would probably do better. The ordinary expenses were £68,637, against, in the corresponding half-year, £67,953. These figures, however, included the sum of £1,935 for depreciation of cable stores, which did not appear in the charges for 1879. Had it not been for this and exceptional expenses for supplying split pipes for the Gibraltar land line—about £1,000—the expenditure for the half-year would have been considerably less. The extraordinary expenses amounted to £19,896, against £23,935 in the corresponding half-year. This item included expenses of several ships which had been despatched to repair cable. They had carried to general reserve £78,205, against £16,876 in 1879. This made the total reserve £287,569. Six months ago he gave a detailed account of the position of the company, showing the whole working and the probable future profit. To that statement he had very little to add, further than that the cables were all in good order, and that the staff, so far as efficiency was concerned, had shown much improvement. The Cape cable, he was glad to say, had improved more than they had expected. Their calculation was something like 20 messages per day, and the average had doubled that amount. Therefore there was every hope that it would prove better than they had any reason to expect. As to the Algiers traffic, he thought they had not been treated fairly by the French Government, but the cable was useful in developing Egyptian and Eastern traffic. Egypt was the stepping-stone to India, Australia, and New Zealand, and that was to them a most important station. He was hopeful, however, that when the Government of France became more settled, they would be able to deal with them on fair and reasonable terms. As to the question of dividing, he said that they were carrying forward this half-year £75,000, against £16,000 last half-year. His idea of perfect safety was that they ought to carry forward £100,000 a year to reserve until the fund arrived at a respectable figure. He thought that it would be desirable to pay the 5 per cent. permanent dividend, and then, after they were able to pay the £100,000 to the reserve, they might divide the balance in the form of a bonus. By adopting this course, he thought that the value of their property would be largely increased. The Marquess of Tweeddale seconded the motion. Major Leslie moved, as an amendment, than an addition of sixpence per share should be paid in the shape of dividend for the half-year, which would give them a dividend at the rate of 6 per cent. per annum. The effect of this, he thought, would be to make their shares more valuable in the market. The chairman stated that, according to the articles of association, the amendment could not be received. He did not desire to be bound to 6 or 7 per cent., but that the shareholders should have the entire surplus divided as bonus. After some discussion, the original motion was carried with only one dissentient, and the directors were unanimously authorised to assist the servants of the company in insuring their lines, provided the amount paid from the revenue of the company did not amount to more than one-half of the insurance premiums. After further discussion, the action of the board in purchasing, on behalf of the company, the 19,000 fully-paid shares of £10 each of the Eastern and South African Telegraph Company, was approved.

CUBA SUBMARINE TELEGRAPH COMPANY.—The half-yearly general meeting of this company was held on July 21st at the offices, Old Broad Street, under the presidency of Mr. T. Hughes, Q.C. The chairman, in moving the adoption of the report (see TELEGRAPHIC JOURNAL, p. 252, previous issue) and accounts, stated that the traffic receipts were £1,000 in excess of those of the corresponding period of last year, which was an increase of 6½ per cent. It had been stated that the increase ought to be 10 per cent., but he did not know that that had been the experience of many companies of late years. He (the chairman) thought, at any rate, that they would agree that the increase they had had was satisfactory in these times. After speaking of the increase of dividend, and the necessity of carrying forward a good amount, he referred to the breakage in the Cienfuegos-Santiago section of the cable, and said that their manager was now engaged in repairing it. Mr. A. F. Low seconded the motion, and it was carried unanimously. The dividend was next declared, and the retiring director and auditor were afterwards re-elected. A vote of thanks to the chairman and directors closed the proceedings.

THE DIRECT UNITED STATES CABLE COMPANY, LIMITED.—The report of the directors for the six months ending 30th June, 1880, to be presented at the sixth ordinary general meeting of the company, states that the revenue for the half-year, after deducting out-payments, amounted to £82,149 0s. 3d. The working and other expenses for the same period, including interest on debentures, and income-tax, &c., amounted to £22,863 13s. 9d., leaving a balance of £59,285 6s. 6d. as the net profit for the half-year; making, with £15,677 16s. 7d. brought forward from the previous half-year, a total of £74,963 3s. 1d. Three quarterly interim dividends of 1¼ per cent. each, amounting to £45,532 10s., have been declared and paid at the usual times during the financial year, and a final dividend of 5s. per share is now proposed, making, with the three interim dividends, 5 per cent. for the year, being a total distribution of £60,710. The appropriation of the above balance of £74,963 3s. 1d. on the revenue account is thus shown:—Interim dividend for quarter ending 31st March last, £15,177 10s.; final dividend now proposed, £15,177 10s.; carried to reserve fund, thereby increasing it to £175,000, £22,847 14s. 3d.; carried forward to next account, £21,760 8s. 10d. The cables are now, and have been during the past year, in good working order. The cable of the Compagnie Française du Télégraphe de Paris à New York having opened for traffic, the English companies have met the competition thus forced upon them, by the reduction of rates. The application of the Duplex system has largely increased the carrying power of the company's cable. The directors have had under consideration the question of establishing an assurance fund for the company's staff on the same principle as that recently sanctioned by the shareholders of the Anglo-American and Eastern Telegraph Companies—viz., to enable the staff to secure the payment to themselves of a limited sum at a given age, or to their families in case of death, the company paying one-half the requisite premiums. The total cost to this company would not exceed £1,000 per annum. The directors recommend this measure to the shareholders as being one calculated to promote the efficiency of the service by encouraging the staff to remain permanently attached to the company. A resolution empowering the directors to carry out the above arrangement will be submitted to the meeting. Pursuant to the provisions of the articles of association two of the directors—viz., William Ford, Esq., and C. J. Günther, Esq., retire by rotation, and being eligible, offer themselves for re-election. Mr. J. G. Griffiths and Mr. Joseph Sawyer, the auditors, retire pursuant to the articles of association, and offer themselves for re-election. The meeting will be held at the City Terminus Hotel, Cannon Street, on the 29th July, at 12 o'clock noon.

TELEGRAPH CONSTRUCTION AND MAINTENANCE COMPANY.—The half-yearly general meeting of this company was held on the 20th inst., at 38, Old Broad Street. The chairman (Sir Daniel Gooch) said: Gentlemen, as the object of this meeting is more to give you a short account of the work which is in hand than for anything else, I will state shortly to you what we have done during the last half-year. We have laid 120 miles of cable in New Zealand. We have laid 550 miles of the Hong-Kong and Manila line; we have made a contract with the Anglo-American Company, just about the time of our last meeting, for laying 1,500 miles of cable, with the view of repairing the 1866 cable of their system, and also to lay a new cable between Newfoundland and Nova Scotia, about 290 miles long. The ship with the latter portion left on the 11th inst., and I hope she is on the ground now. The *Scotia* will leave before the end of the month, and the *Kangaroo* with the remaining portion of the Atlantic cable, and we hope in a very short time these services will be successfully completed. I may state that Captain Slocomb is in charge of the expedition, and his experience and care in these matters give us great confidence that everything will go well. Then we have sent a ship, just started—a ship with a small house and land lines that we had to complete the Cape cables, and when those are finished that is the last work at the Cape we have got to do. That is all I have to say with regard to the work done during the half-year. The work that we have got in future we do not know much about. We are negotiating now for some cable, but it is as yet indefinite, and in future we are dependent a little on what orders may come in. After remarks from Mr. Abbott and others, and the usual votes of thanks having been accorded, the proceedings terminated.

THE GLOBE TELEGRAPH AND TRUST COMPANY, LIMITED.—The report of the directors to be presented to the seventh ordinary general meeting, 30th July, 1880, states that the net revenue of the company for the year, after deduction of expenses, amounts to £169,587 13s. 7d., which, with the balance of £973 14s. 1d. brought forward, makes a total of £170,561 7s. 8d. From this amount there has been distributed in interim dividends the sum of £119,887 14s., and the directors have written a further sum of £1,000 off the preliminary expenses account, leaving an available balance of £49,673 13s. 8d. The directors now recommend payment of a final dividend for the year of 3s. per share on the preference shares, and of 3s. per share on the ordinary shares (making, with the former distributions, a total dividend for the year of 6 per cent. upon the preference and 4½ per cent. upon the ordinary shares), carrying forward a balance of £841 12s. 8d. The directors have issued 4,000 preference and 4,000 ordinary shares of £10 each, in exchange for 4,000 £20 shares of the German Norwegian Submarine Cable Company. This company was formed in Berlin in 1879, with a capital of £87,500, for laying a cable between Germany and Norway, upon the basis of a subvention of £7,000 per annum from the German Government, with a share in the tariff receipts. The capital is to be redeemed by an amortization fund and yearly drawings. The dividend runs from the 1st January last, and is estimated to be not less than 6 per cent. per annum, although no payment will be received in time to appear in this year's accounts. Twelve

shares have since been drawn and paid off at par in accordance with the statutes. Exchanges have also been made for the following, viz.:—115 Submarine Cable Trust £100 certificates, 1,600 Eastern Extension £10 shares, 100 Eastern Telegraph £10 shares, and 374 Indo-European £25 shares. The 39 5 per cent. debentures of the Western and Brazilian Company of £10 each, issued at £8, have been paid off at par. In conformity with the articles of association, Mr. John Pender, M.P., and Sir James Anderson, two of the directors, retire; but, being eligible, they offer themselves for re-election. The auditors, William Newmarch, Esq., F.R.S., and John George Griffiths, Esq., also retire at the meeting, and offer themselves for re-election.

SUBMARINE CABLES TRUST.—The report of the trustees to be presented to the ninth ordinary annual meeting of the certificate holders, to be held at the offices of the Trust, 66, Old Broad Street, London, on the 30th day of July, 1880, states that the accounts were prepared and audited to show the actual receipts and disbursements during the twelve months ending April 15th, 1880. As the dividend which had accrued on the shares of the Eastern Extension Telegraph Company to 31st December, 1879, amounting to £1,696, was not paid until April 21st, it is not included in the revenue account now submitted, but will be brought to the credit of the current financial year. The revenue for the twelve months to 15th April, 1880, including a balance of £11,913 15s. 4d. brought from last year's accounts, amounted to £35,046 6s. 6d. The expenses of the trust absorbed £1,420 14s. 11d., leaving an available balance of £33,625 11s. 7d. From this sum three coupons have been met amounting to £31,086, carrying forward a balance of £2,539 11s. 7d. The certificate holders will remember that in April last year an injunction was granted by the Master of the Rolls, restraining the trustees from dealing with the funds of the trust except under the direction of the Court. In January last a decree was made ordering the trust to be wound up. Against this action the trustees appealed, and a decision has just been given by the Lords Justices reversing the decree of the Master of the Rolls. The securities held by the trustees are precisely the same as on the date of the last report. It will be observed that about 18 per cent. of the certificates have been already redeemed. The meeting will have to elect auditors for the current year. Mr. William Newmarch, F.R.S., and Mr. J. G. Griffiths (Messrs. Deloitte, Dever, Griffiths & Co.) retire, and, being eligible, offer themselves for re-election.

Mr. G. VON CHAUVIN has resigned his position as general manager of the "Compagnie Francaise du Telegraphe de Paris à New York." As the directors of that company still endeavour to maintain a 2s. tariff in the face of their competitors' rate of 6d. per word, it seems to us no other course was open to one so experienced in such matters as Mr. Von Chauvin.

The following are the final quotations of telegraphs.—Anglo-American Limited, 62½-63; Ditto, Preferred, 92-93; Ditto, Deferred, 35¼-35½; Black Sea, Limited, ——; Brazilian Submarine, Limited, 8⅛-8¼; Cuba, Limited, 10-10½; Cuba, Limited, 10 per cent. Preference, 16½-17½; Direct Spanish, Limited, 1¾-2¼; Direct Spanish, 10 per cent. Preference, 11¼-11½; Direct United States Cable, Limited, 1877, 12-12¼; Scrip of Debentures, 102-104; Do., £50 paid, 1-3 pm.; Eastern, Limited, 9⅛-9⅜; Eastern 6 per cent. Preference, 12½-12⅝; Eastern, 6 per cent. Debentures, repayable October, 1883, 103-106; Eastern 5 per cent. Debentures, repayable August, 1887, 104-107; Eastern, 5 per cent., repayable Aug., 1899, 105-108; Eastern Extension, Australasian and China, Limited, 9⅛-9¼; Eastern Extension, 6 per cent. Debenture, repayable February, 1891, 108-111; 5 per cent. Australian Gov. Subsidy Deb. Scrip, 1900, 102-104; Ditto, registered, repayable 1900, 102-105; Eastern and South African, Limited, 5 per cent., Mortgage Debentures redeemable 1900, 100-103; Ditto, ditto, to bearer, 100-103; German Union Telegraph and Trust, 9-9½; Globe Telegraph and Trust, Limited, 6⅞-6⅞; Globe, 6 per cent. Preference, 12½-12¾; Great Northern, 9⅜-9⅝; Indo-European, Limited, 23½-24½; London Platino-Brazilian, Limited, 4¾-5¼; Mediterranean Extension, Limited, 2¾-3¼; Mediterranean Extension, 8 per cent. Preference, 10¾-11; Reuter's Limited, 9½-10½; Submarine, 245-255; Submarine Scrip, 2⅛-2⅜; West Coast of America, Limited, 2¼-2½; West India and Panama, Limited, 1⅛-1⅜; Ditto, 6 per cent. First Preference, 7⅛-7⅜; Ditto, ditto, Second Preference, 6¾-7¼; Western and Brazilian, Limited, 6½-6¾; Ditto, 6 per cent. Debentures "A," 100-103; Ditto, ditto, ditto, "B," 97-100; Western Union of U. S. 7 per cent., 1 Mortgage (Building) Bonds, 120-125; Ditto, 6 per cent. Sterling Bonds, 104-107; Telegraph Construction and Maintenance, Limited, 33¾-34¼; Ditto, 6 per cent. Bonds, 105-108; Ditto, Second Bonus Trust Certificates, 3⅛-3⅜; India Rubber Company, 15-15½; Ditto 6 per cent. Debenture, 105-107.

TRAFFIC RECEIPTS.

Name of Co., with amount of issued capital, exclusive of preference and debenture stocks.	Anglo-American Co. £7,000,000.	Brazilian Sub. Co. £1,300,000.	Cuba Sub. Co. £160,000.	Direct Spanish Co. £116,379.	Direct U.S. Co. £1,213,900.	Eastern Co. £3,697,000.	Eastern Ex. Co. £1,997,500.	Gt. Northern Co. £1,500,000.	Indo-Euro. Co. £425,000.	Submarine Co. £338,225.	West Coast America Co. £300,000.	Western and Brazilian Co. £1,398,200	West India Co. £883,110.
	£	£ a	£	£	£	£	£	£	£	£	£	£ a	£
June, 1880 ...	*	10,882	2,700	1,277	*	42,522	29,100	22,520	... ...	*	... ...	8,916	4,017
June, 1879 ...	45,000	11,021	2,425	1,025	15,000	36,635	26,485	19,618	... ...	10,661	725	9,379	3,970
Increase	... ...	... ...	275	252	... ...	5,887	2,615	2,802	... ...	... ...	... ...	... ...	47
Decrease	... ..	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...

* Publication of receipts temporarily suspended. a Four weeks compared with thirty days of June, 1879.